

between the lines **Dr Darrin Baines**

NICE, the universe and everything

Do health economics and NICE hold the answers to the great questions of life?

There are three [sic] types of people in the world; those who believe numbers are reliable and hold the secrets of the Universe, and those who don't.

In the master work of the late Douglas Adams, the *Hitchhiker's Guide to the Galaxy*, the super-computer Deep Thought proclaimed (with infinite majesty and calm) that the answer to the great question of life, the Universe and everything is the number 42.

As you either know or can imagine, Phouchg and his cosmic travelling companion in the book, Loonquawl, didn't quite know what to do next when they heard this earth shattering news.

In this uncertain world, it is not only fictional space travellers who discover that numbers are unreliable.

When an IBM researcher, Gregory Chaitin, was examining the 'halting problem' suggested by the British mathematician, Alan Turing, he found it impossible to predict whether a hypothetical computer would ever come to the end of a random program it has to perform.

In response, he concluded that some numbers (such as the probability of an imaginary computer program ceasing) are simply unknowable. In doing so, he exposed gaping holes in mathematics and demolished the profession's hopes of ever finding a theory of everything.

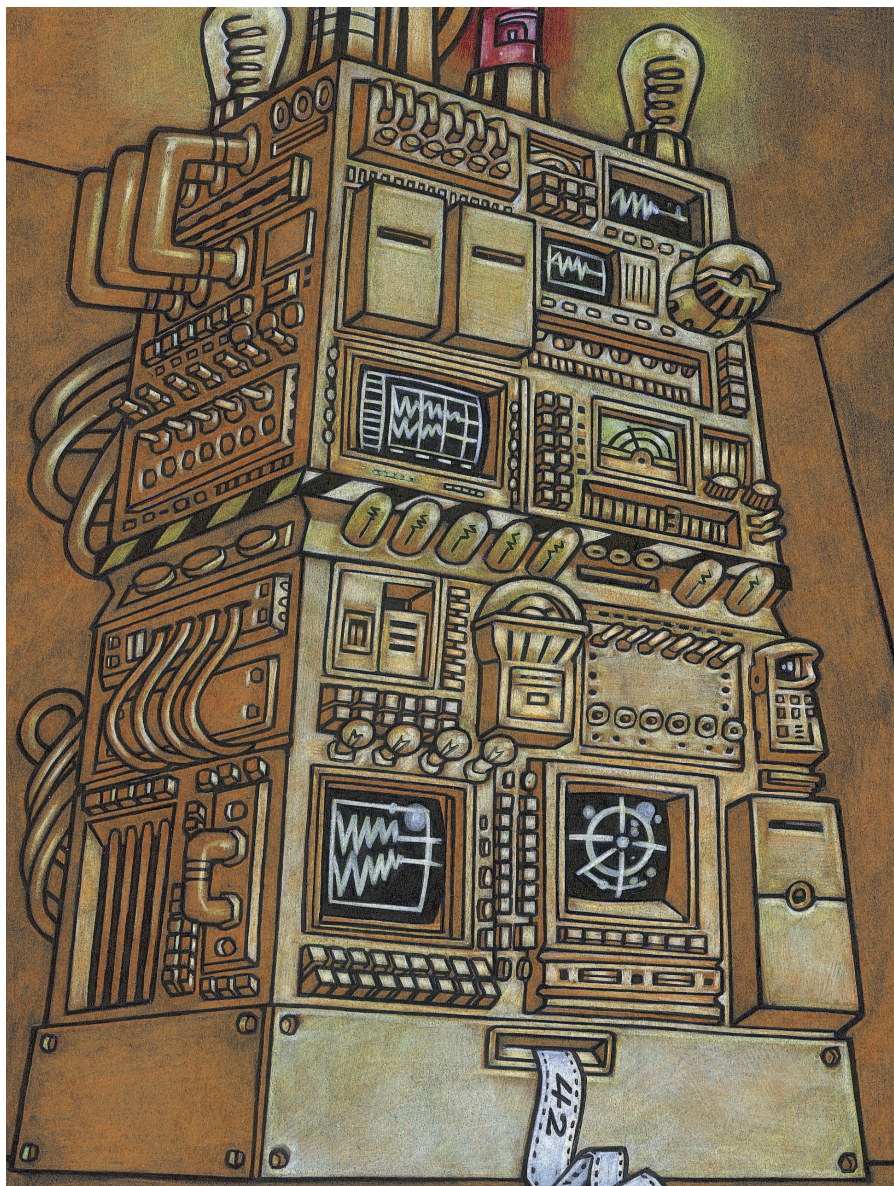
Therefore, pay your money and take your choice. On the one hand, you can side with the fantasists who believe numbers are the fountains of all knowledge. On the other, you can befriend Chaitin and his mates and realise that mathematical truths only exist by chance and that nothing is ever certain in this expanding and evolving Universe.

Fashion victims

Recently, health economics has become an extremely fashionable way of trying to understand healthcare provision.

Although it can do other things, the discipline is mainly concerned with measuring the cost-effectiveness of health technologies. To do this, health economists undertake economic evaluations of alternative interventions by comparing their relative costs and benefits.

To perform their cost-benefit studies,



health economists must calculate the resources expended and outcomes secured when an intervention is used.

In relation to the former, resources such as staff time, overheads and expenditure on treatments utilised are often measured in money terms.

In relation to the latter, the benefits produced by an intervention may be measured in a number of ways. For example, gains from treatment may be recorded as effectiveness (such as patient survival gains), monetary benefits (how much patients would be willing to pay for

the benefits they expect to receive), or in terms of patient utility (that is, the value of the improvements in patient health status).

Mathematical conundrum

I don't usually criticise health economists, as I trained as one myself, however, the way the profession measures health outcomes gives me cause for concern.

As my worries are mathematical in nature, it may be better to start by outlining the difference between ordinal and ratio numbers before I launch my attack.

Firstly, ordinal numbers identify the ►►

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► order in which events or things occur. For example, being first, second or third in a race is an ordinal ranking, as it simply tells us the order in which competitors crossed the line.

The problem with ordinal numbers is that we may compare them but we learn little from doing so. For instance, if you came first in a race and I came second, the numbers 'one' and 'two' tell us nothing about the distance between us at the end. We could have been millimetres, metres or miles apart.

In comparison, numbers measured on a 'ratio scale' indicate the relative size of things, such as the height of students in a class. Ratio numbers may be added, subtracted, multiplied and divided as the distance between them actually means something (eg, the sum distance between London and Milton Keynes and Milton Keynes and Birmingham gives the distance between London and Birmingham).

Measure the measurable

In response to the limitations of traditional measures of clinical effectiveness, health economists developed a range of Quality Adjusted Life Year (QALY) instruments designed to capture improvements in patient health status and length of life.

Although they differ in construction, the QALY measures created by health economists usually rank patient health states using a ratio scale of utilities.

Let me use a hypothetical example to explain this method. If you are in full health for one year you receive a score of 1. If you are not, perhaps because of serious pain, your current health status could be ranked 0.5, which is half as good as being at the maximum value of one. Finally, if you are in your worst possible health state, you'd get a 0.

Even though we'd all agree that being in pain is often (but not always) better than being in your worst possible state of health, but worse than being in full-health, we may not agree that we can measure different health states using a ratio scale.

On the contrary, I would argue that different health states can only be ordered in terms of their attractiveness, but they cannot be measured like the height of children in a class or miles on a road. In short, ordinal measurement is only possible here.

Think of a number

Health economists often use the scores derived from QALY measures to construct 'cost-per-QALY' estimates for competing health technologies.

When these figures are calculated, the interventions with the lowest cost per QALY are deemed the most economical or the best value for money.

Although bodies like NICE evaluate alternative healthcare interventions using cost per QALY calculations, I am not sure whether health economists, civil servants or anybody else actually knows what the values associated with this variable actually mean.

To help explain my concerns, let me outline the complicated, multi-stage procedure involved in the calculation of this cost-utility ratio. Firstly, many QALY instruments – such as the EQ5D – record patient health status using responses to questions about their health state.

Next, the QALY scores provided by patients are converted into 'values' using a 'tariff'. This consists of weights derived from national or international studies of how random groups of people value different health states.

However, this approach may be flawed as it assumes the order in which health states are ranked by patients can be measured like distance along a road or like height of children in a class.

During the next step, the weighted scores are multiplied by the length of time each patient spends in their current health state.

Aggregation

Once QALY estimates have been derived for the individual, the weighted values for all patients in a trial are added together to produce the total QALY gain.

Then this data is divided by the amount of resources used by each patient to give a 'cost per QALY' figure.

To most health economists this procedure seems normal. To me, the whole thing seems bizarre and inexplicable, as the initial data is so manipulated and changed I wonder whether the numbers produced at the end actually tell us anything about anything. In particular, I am concerned with the assumption held throughout the process that health states can be converted into ratio numbers.

If this assumption does not hold, the final cost per QALY estimates produced by this method will be unreliable and will tell us nothing about the cost-effectiveness of drugs or any other healthcare interventions studied.

Just a little bit of magic

Just like the imaginary computer Deep Thought, NICE is searching for a magical number that answers the great 'quality of life' question it was established to consider; how much should the NHS pay for each quality-adjusted year of life it buys?

From the appraisals completed to date, some commentators have argued that the body believes the answer to be £20,000 per QALY, give or take a few thousand pounds. Others suggest that the figure is

nearer £30,000, depending upon which QALY measure we use.

Therefore, drugs that are significantly more costly than the cost-effective threshold (whatever it may be) often fail the NICE test, whilst cheaper ones are welcomed fondly into the NHS family.

Problems ahead

Although NICE has noble intentions, there may be a major flaw in its overall approach to appraisals – the £20,000 or £30,000 figure is only valid if cost per QALY data actually measures the efficiency with which patient health gain may be generated.

Unfortunately, I don't think health economists or NICE actually know what the cost per QALY estimates they produce and use actually mean.

However, they like to use measures like the EQ5D because they are simple and easy to apply and not necessarily because they are scientifically sound. As a result, the economic evaluation methods employed by health economists and reviewed by NICE may be as full of holes as the branches of mathematics the IBM researcher, Gregory Chaitin, examines.

In response, you can either side with the evaluators who believe QALY numbers are the fountains of all knowledge.

Alternatively, you can realise that in the expanding and evolving university and consultancy market for health economics services finding truth may be less important than finding fees.

Disappearing universes

According to the author of the *Hitchhiker's Guide*, there is a theory which states that if ever anyone discovers exactly what the Universe is for and why it is here, it will instantly disappear and be replaced by something even more bizarre and inexplicable.

However, he also warned that there is also another theory stating that this has already happened.

In response to Adams' first theory, I'd like to make a prediction of my own; if pharma ever discovers that the 'cost per QALY' ratio could be meaningless, the industry would instantly become even more doubtful about the appraisal methods used by NICE and demand new ones are put into place.

However, in keeping with Adams' second theory, we may have already moved to a bizarre and inexplicable future the day health economists suggested introducing QALY data into clinical trials.

THE AUTHOR

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